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Mitsuharu Kawaguchi

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EXAMINER

TREAT, WILLIAM M

ART UNIT

PAPER NUMBER

2181

DATE MAILED: 11/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/862,471

Applicant(s)

KAWAGUCHI, MITSU HARU

Examiner

William M. Treat

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 and 6-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 6-12 is/are rejected.
- 7) ☒ Claim(s) 13-15 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

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1. Claims 1-4 and 6-15 are presented for examination.
2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1-2 and 6-12 are rejected under 35 U.S.C. 102(b) as being anticipated by Hunt (Patent No. 5,740,391).
4. Hunt taught the invention of exemplary claim 1 including an instruction buffer (316) for a pipeline processor (310) comprising: a sequence of instructions arranged in an order determined beforehand (col. 7, lines 25-67); a first buffer (342) including entries arranged in a preselected entry number order for storing said sequence of instructions; and a second buffer (344) including other entries for storing instructions, wherein an instruction stored in any one of said other entries earlier than other instructions is issued earlier than said other instructions, wherein any one instruction of said sequence of instructions stored in any one of the entries of the first buffer designated by a relatively lower entry number than another instruction in another entry is prior, in order, to another instruction stored in another entry of the first buffer different from the entry containing the one instruction designated by a relatively higher entry number than said one instruction of said sequence of instructions: and wherein said first and second buffers each issue instructions in storage entry order (col. 6, lines 52-62; col. 7, lines 25-67; and Figs. 4(a-c)).

5. As to claim 2, Hunt taught the instruction buffer as claimed in claim 1, wherein the entries of the first buffer each show whether or not the instruction stored therein is ready to be issued. At col. 7, lines 29-34, Hunt states: "In the preferred embodiment system 300 of FIG. 3, the instruction buffer 316 is reordered by the hardware to maximize pipeline efficiency such that instructions which are not waiting for a result from prior instructions are launched for execution first." In the preferred embodiment the order of each entry indicates whether or not the instruction stored in the entry is ready to be issued.

6. As to claim 6, Hunt taught a method of controlling a buffer queue for a pipeline processor, comprising the steps of: generating a first group of instructions in a priority order determined beforehand; generating a second group of instructions belonging to said first group of instructions and capable of being executed; and executing one of said second group of instructions highest in said order among said first group of instructions (col. 6, lines 52-62; col. 7, lines 25-67; and Figs. 4(a-c)). Note, in particular, col. 7, lines 34-56.

7. As to claim 7, Hunt taught the method as claimed in claim 6, further comprising the steps of: generating a third group of instructions included in said first group of instructions; and generating a fourth group of instructions included in said first group of instructions and not dependent on said third group of instructions; wherein when one of said fourth group of instructions highest in order does not belong to said second group of instructions, none of said fourth group of instructions is executed. Note that in Figs. 3 and 4(a-c) Hunt has depicted a pipelined computer with an ALU unit and a memory

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management unit with a FIFO instruction buffer for each unit which would result in issuing one instruction to each unit. Based on how Hunt describes the system of Figs. 4(a-c) (col. 7, lines 34-56) an instruction of the second group would issue before an instruction of the fourth group.

8. As to claim 8, Hunt taught the method as claimed in claim 7, wherein one of two instructions belonging to said third group or fourth group of instructions is not executable until the other instruction of said two instructions is executed (col. 7, lines 42-54).

9. As to claim 9, Hunt taught the method as claimed in claim 8, wherein the instructions belonging to said third group are executed at the same time as the instructions belonging to said fourth group (col. 7, lines 34-56).

10. As to claim 10, Hunt taught the method as claimed in claim 9, wherein the instructions belonging to said third group and the instructions belonging to said fourth group are operation instructions and memory access instructions, respectively (col. 7, lines 54-56).

11. As to claim 11, Hunt taught a buffer queue control for a pipeline processor comprising: a reorder buffer for registering a plurality of instructions in an order of instructions; a first buffer for storing first instructions included in the plurality of instructions; a second buffer for storing, among the plurality of instructions, second instruction other than the first instruction; said second instruction including an instruction that should be issued after said first instruction; said first buffer including a plurality of first entries for sequentially storing the first instructions in said order of instructions; said

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buffer queue control further comprising: means for releasing any one of the plurality of first entries that stores an instruction that issued; means for shifting any one of the first instructions that is not issued to an entry prior, in order, by one; means for issuing one of the second instructions, which can be issued, earliest in said order of instructions; and means for deleting any one of the plurality of instructions that has been executed and is earlier, in said order of instructions, than instructions not executed (col. 7, lines 34-56). Note that the pointer (PTR_EXECUTE of Figs. 4(a-c)) provides for a logical shift of instructions by one as opposed to a physical shift by one. Since applicant does not differentiate as to the type of shift, this is not a distinguishing point for applicant's claims. And, were applicant to claim a physical shift the examiner would not consider that to distinguish over other conventional instruction buffers which physically shift given Hunt's statement that "the method of arbitrating for launching and method for launching instructions for execution may be implemented using any workable scheme" (col. 7, lines 34-36).

12. As to claim 12, Hunt taught, the buffer queue control as claimed in claim 11 further comprising the means for issuing any one of the first instructions that is earliest in said order of instructions and ready to be issued (col. 7, lines 24-56).

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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14. Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hunt (Patent No. 5,740,391).

15. As to claim 3, Hunt taught the instruction buffer as claimed in claim 2, wherein the instruction first issued is from among the entries of the first buffer whose instructions are ready to be issued (see paragraphs 4-5, *supra*). He did not specifically teach issuing "the entry having a lowest entry number among said entries of the first buffer whose instructions are ready to be issued"; however, the examiner takes Official Notice the method claimed is conventional. One of ordinary skill is motivated to use the method (i.e., issue the one having the lowest logical entry number among the instructions ready to be issued (i.e., the first one in program order)) because, to do otherwise, requires additional logic to track instructions passed over and, potentially, retards the instruction retirement process slowing overall processor performance.

16. As to claim 4, whether the entries of the first buffer storing the instructions are lower in logical or physical entry number order than the entries storing no instructions as in a circular buffer used as a queue (logical) or a queue which constantly shifts in new instructions at the top (physical), the examiner takes Official Notice of the fact both are conventional methods "for launching instructions for execution" (col. 7, line 35) and fall within the scope of Hunt's invention. One is motivated to use such conventional methods because they are well-known and readily implemented by one of ordinary skill.

17. Applicant's arguments filed 8/25/05 have been fully considered but they are not persuasive with respect to claims 1-12.

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18. Applicant has argued, in substance, on behalf of claims 1-12 that (a) Hunt has only a single instruction buffer; (b) Hunt fails to teach or contemplate any difference in order of instructions; (c) Hunt does not teach first and second buffers wherein each issues instructions in storage entry order and addition of a parallel path with out of order instructions would be inconsistent with Hunt's teachings; and, (d) Hunt clearly fails to teach or suggest such a method for controlling a buffer queue where instructions in two different groups are contemporaneously executed.

19. As to 18(a), while Hunt does reference the totality of his instruction buffering capacity using the numerical designation (316), he also specifically teaches an ALU instruction buffer (342) separate from his memory instruction buffer (344). The examiner would suggest applicant reread col. 6, lines 52-55).

20. As to 18(b), Hunt both taught and contemplated a difference in order of instructions (col. 7, lines 29-34 and col. 7, lines 38-42).

21. As to 18(c), Hunt does teach first and second buffers wherein each issues instructions in storage entry order (col. 7, lines 29-34) and a parallel path with out of order instructions (col. 7, lines 29-34 and col. 7, lines 38-42).

22. As to 18(d), Hunt clearly teaches controlling a buffer queue where instructions in two different groups are contemporaneously executed (col. 7, lines 29-34). Clearly, Hunt thinks his teachings are sufficient for one of ordinary skill. Applicant has not presented any evidence or cogent argument explaining why he thinks Hunt has separate instruction buffers (342, 344), has separate busses for those buffers (Fig. 3),

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and has separate execution units for each buffer and bus (318, 320); yet, he would only contemplate serial execution of instructions.

23. Claims 13-15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

24. Claims 13-15 are allowable because the prior art of record does not teach a buffer queue control as claimed in claim 12, wherein said second buffer comprises a plurality of second entries each for storing a particular one of the second instructions in said order of instructions, and an issuance pointer for controlling issuance of said second instruction, and wherein said reorder buffer comprises a head pointer indicative of an entry that has been issued last.


25. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

26. A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

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Any inquiry concerning this communication should be directed to William M. Treat at telephone number (571) 272-4175. The examiner works at home on Wednesdays but may normally be reached on Wednesdays by leaving a voice message using his office phone number. The examiner also works a flexible schedule but may normally be reached in the afternoon and evening on three of the four remaining weekdays.

27. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'W. M. Treat', with a stylized flourish at the end.

**WILLIAM M. TREAT
PRIMARY EXAMINER**